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ABSTRACT

Computer systems comprised of a central computer, terminal, software programs, and a communication channel are being placed in charge of thousands of students for individualized instruction in various subject areas. The most prevalent uses of the computer as a teaching instrument include (1) drill and practice, (2) tutorial, (3) dialogue, and (4) simulation and game modes. Non-instructional applications support education in such areas as library information retrieval, guidance and testing, and administrative recordkeeping. Advantages of using a computer assisted instruction program include the increased availability of teacher time, individualized learning at the student's own pace, and reduction of learning time. A serious drawback has been the limited scope approach used to evaluate effectiveness, in which the computer's potential to teach has been judged by the effectiveness of a specific lesson, course, or technique. (CHV)

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An Introduction To Computer Applications In Support of Education

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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During the mid to late 1960's, the computer became a symbol of a dehumanizing society. These feelings manifested themselves mostly on college campuses in the form of demonstrations calling for the end of a computerized, programmed society.

Today, these same campuses are returning to computers for augmenting their educational needs. In education, computers are enabling teachers to create new and innovative quality education. Computer systems, comprised of a central computer, terminal, software programs, and a communication channel of some sort, are being placed in charge of thousands of students to instruct themselves in various areas. How this basic computer system is used in education is the topic of this paper.

The instructional applications of the computer inside the classroom to directly support the interactions between student, subject matter and teacher is known as Computer Assisted Instruction, C.A.I. The most prevalent uses of the computer as a teaching instrument are:

1. drill and practice - using the computer as a tireless teacher to ask the student questions until mastery is acquired.
2. tutorial - the computer is used for transmitting information about the student's progress through a course, and tests him to find out what he has learned. By storing information programmed previously, the computer program designed by the teacher, can use the responses of the student to determine the next instructional sequence.
3. dialogue - building on tutorial, the computer not only asks questions, but provides the student with relevant data on

problems, does the calculations necessary, and evaluates the student's efforts in solving the problems through the possibility of a natural language dialogue with the student.

4. simulation and game modes - replicates a real situation or environment to test how the student reacts.

The above four methods of teaching with a computer are what is usually thought of as C.A.I. However, Salisbury (1971) offers a more complete scheme to Computerized Instruction (see chart attached at end).

Salisbury conceptualizes computer applications in support of education as two main hemispheres, instructional and non-instructional. Under instructional applications, is area one, termed Computer Administered Instruction (CAI). In this catagory are drill and practice, tutorial, dialogue and simulation. Area two is known as Computer Supported Instruction (CSI). This catagory includes learning areas which are supported by the use of computers as a tool or an aid. For example, a course Survey of Computer Science is, by Salisbury's definition, a course in CSI because it teaches about computers.

Non-instructional applications support education outside of the classroom. Ancillary use is problem solving by students, faculty and staff working with the computer. An example of this is computerized library information retrieval. In administrative use, the computer calculates payroll, keeps student records and can be used in guidance and testing.

In both spheres, instructional and non-instructional, is an area of overlap called Computer Managed Instruction (CMI). This involves

using the computer to integrate information about student grades, personality and available information about the curriculum in order to make individual programs of study for each student. These are the applications published by Salisbury in 1971, and are becoming widely accepted by the educational community.

Computers in support of education have had records of failure and success. One of many successful schools in implementing the potential of CAI is the Chicago School System, which placed a CAI system in its ghetto schools in 1970 to teach reading and math. By 1971 a central computer and 105 terminals were available, connecting 32 schools. Testing was begun in grades four through eight. Many of these students were at least 1.5 grade levels behind in reading. Within eight months each child had advanced approximately 1.1 years in his/her reading ability. The Chicago school board was so impressed that in 1974 they invested enough money to add an additional 407 terminals.[1]

Early developments of automated teaching were recorded in the 1930's, 40's, and 50's. Between 1964-1966, The National Science Foundation project at Dartmouth College and at MIT was seriously conducting the beginnings of computerized classroom instruction. Studies from 1964-1968 by Lumsdaine, Atkinson and Wilson, found three prime factors for amazing growth of CAI in test areas. The first factor was the impact of an educational discipline known as Educational Technology. With the application of all kinds of mechanized and electronic tools, CAI was being molded into more specific patterns. Another reason for the impact on Educational Technology on the growth of CAI was the increasingly complex studies being conducted in behavioral science, and

the fields of communications, cybernetics and perception theories. Because of psychologists like B. F. Skinner, more emphasis was being placed on behavior and learning, causing more sophisticated educational technology.

A second factor in the rise of CAI was the growth of the data processing industry. Increasing numbers of businesses were incorporating more data processing into their management practices. Use of data processing equipment moved into government offices, transportation, and education.

The third factor was the aid of the Federal Government to education, via the National Science Foundation. With Federal funding, the National Science Foundation was able to do more and better research in the field of computers in education.

These three factors led to the first actual implementation of computers in the classroom. The first was PLATO I in 1959. In 1962, PLATO II was substituted in for PLATO I, with better and upgraded technology. The PLATO studies continued with PLATO III (1964) and PLATO IV (1970). After researching the test data, it was found that there were conclusive results from each Plato program. In each program it was discovered:

- CAI absorbs the interest of students of all ages.
- feedback of the information provided by the computer can be applied not only to the learning processes of the student, but to the teaching process of the teacher as well.
- CAI lessons can be easily modified for other applications.

CAI is a plausible way to individualize instruction in a wide array of subject material areas.[2]

About the same time as PLATO III, several major colleges began their own studies and test programs. Among the colleges were Pennsylvania State University (1965), The University of Pittsburgh (1964), Florida State University, Harvard College, The University of Texas, and also the Philadelphia School System (all in 1965).

In 1969, the National Technical Institute for the Deaf began exploration of the effects of CAI with the deaf and processes of developing CAI lessons for deaf. In 1969, Pat Suppes, et al., supported by a National Science Foundation grant, evaluated the application of CAI Math and Reading lessons in selected schools for the deaf across the United States. A national survey of schools for the deaf in 1976 revealed 34 CAI installations as opposed to 7 found in 1970. The growth in this field of handicapped education indicates successful applications at various levels.

Computer Assisted Instruction is a complex subject, and therefore, rational development of this subject has just begun. We know the purpose of an instructional program is to teach in a situation favorable to learning. We also know that CAI is useful because of the power of the system in its ability to display information, and to compute and manipulate logic. The typical elements of instructional strategy and instructional programming are similar for the normal classroom and CAI. An important component of effective and efficient programming is the specification of educational objectives. The computer is neutral and has no inherent capabilities for designing objectives. Therefore, that

responsibility lies with the teacher, who may choose to work with a curriculum development specialist. Together they outline the objectives the teacher hopes to accomplish.

Among educators involved with computer applications in support of education, there is a general taxonomy of learning skills which must be understood before any lessons can be developed. Published by Bloom in 1968, they are:

- knowledge - which is simply the ability to recall.
- comprehension - understanding textual and graphic material or communications. With the comprehension of a subject, the student is able to abstract ideas.
- application - being able to use a principle or idea out of the context in which it was taught.
- analysis - being able to break down a problem into parts to see a relationship between those parts.
- synthesis - taking isolated components of a problem and being able to construct a solution.
- evaluation - the highest order of complexity in learning. The student has the capability of putting together all the previous levels in varying degrees to make sound judgments.[4]

Continuing, Bloom then stated four questions for defining objectives. What should the student be able to do when he finishes a unit or completes a course? Under what conditions should a student exhibit what he/she has learned? What methods should be used to evaluate the student? What level of competence should be considered minimal?[5]

By incorporating the levels of learning with specific objectives, Computer Assisted Instructional lessons can become more and more involved. As of this date, subjects being taught by computers include all academic subject areas. A few are listed below:

- mathematics - from simple arithmetic to integrated calculus
- chemistry - from periodic tables to research methods
- foreign languages - including dictionaries
- reading
- medical diagnosis
- music
- history
- psychology

A serious drawback to CAI has been the approach used to evaluate its effectiveness. In simple terms, the computer's potential to teach has been judged by the effectiveness of a specific lesson, course or technique. It has been common practice to evaluate a drill and practice lesson or tutorial, etc., and make a blanket statement about CAI. Therefore, teachers must consider this problem when they are developing instructional material to be used with the computer. It certainly would be easy for the teacher to program the computer for hours and hours of drill and practice, or tutorial programs, but after a while the student loses his/her interest and motivation drops off. Other methods such as game playing, should be intermixed with the simpler forms of CAI in order to increase the students desire to work with the computer. Variety of instructional experiences appear to be a key to sustaining interest. Any increase in motivation of the part of the student is an advantage in

educational instruction. When a student is motivated, he will learn more.

There are other advantages to using a Computer Assisted Instructional program in education. First, there is the increased availability of the teacher's time. Secondly, individualized learning, at the student's own pace. Third, learning time is reduced. CAI through its data gathering and summary capacity builds a more scientific base for learning helping educators determine which instructional techniques are best. It also provides more immediacy of learning through being able to bring the outside world into the classroom using simulation exercises. Finally, CAI, a distributing media, can give equal access to instruction to all students. By implementing a CAI program in Chicago, the children of the ghettos received as complete an education as the children attending school in the suburban areas.

It appears that more and more applications of the computer will be identified and implemented as the years go by. For now, it is just beginning to meet the promise of improving our current educational system. People of all industries, in all aspects of the working world here in America, should begin to think about the computer not as an instrument capable of reducing man to a number, but capable of reducing the illiteracy of our citizens. The computer used in education is a strength that can be realized and appreciated. Leonard Miller expresses the idea in this way:

> "I would like to express optimism about the promise of CAI, not merely in education but for mankind in general. The computer has the potential of becoming a true extension of man's mind, as the machine has become an absolute extension on of his muscles. If we can achieve better man/machine relationships, the exalting possibility exists of vastly increasing the range of our mental abilities. This is the ultimate Promise."[6]

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ENDNOTES

[1]Jan Bone, "Turning on with AI" American Education, November 1974, p. 31.

[2]Paul G. Watson, Using the Computer in Education: A Briefing for the School Decision Makers (Englewood Cliffs, N.J., 1972) p. 8.

[3]James R. vonFeldt, "A National Survey Of the Uses of Computers for Instruction in Schools for the Deaf" New Directions in Educational Computing, Proceedings 1977 Winter Conference, Wilmington, Delaware, February 1977.

[4]B. L. Hicks and S. Hunka, The Teacher and the Computer (Phil., Pa., 1972) p. 47.

[5]Ibid., p. 49.

[6]Leonard Muller, "Reports from Industry," Computers in the Classroom: an Interdisiplinary view of Trends and Alternatives, ed. Joseph B. Margolin and Marion R. Misch, 3rd ed., (N.Y., N.Y., 1970) p. 127.

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